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THE PROBABLE DANGER FROM WHITE ANTS.

BY DR. H. A. HAGEN.

I INVITE the reader to imagine himself in a forest in the interior of Brazil. There is a clearing in the forest. A small valley covered with underbrush, and containing a fresh water pool, opens before our eyes. Here and there are scattered little hills several feet high, more or less covered with grass. Thick clouds rise slowly and make the close air still more oppressive; the rainy season, the disagreeable summer of the tropics, is approaching. All seems quiet, but suddenly one's attention is attracted by a strange activity beginning in one of the little hills.

As if by witchcraft, a cleft opens in the middle of the hill. A little brown insect comes out with folded wings, followed by two, three, four, and more, in one row, as many as the quickly widening cleft will allow to pass at once. Like a silver ribbon the train winds down the hill, for the membrane of the wings glimmers like mother-of-pearl. These insects take a course just opposite to the wind, as this is the only way in which their delicate wings can resist the pressure of the air. More and more, without interruption, appear hastily, as if driven out of the hill. Other similar clefts have been opened, from which similar trains throng out. The little hill seems to discharge its living lava like a volcano. But the most curious spectacle is seen near the cleft. There appear little wingless creatures with enormous heads and hooked jaws, which they move threateningly, to defend the entrance to their subterranean chambers, and to accelerate the march of their brethren who have been turned out. At last the rows grow smaller and thinner and the clefts begin to close as if walled up by invisible hands. In the mean time the swarm has tried its wings, and rises steadily into the air, keeping close together near the tops of the trees and then gradually falling to the earth. Pretty soon the number of the falling insects increases, and we notice that they are always in couples, male and female, running quickly about and trying to get rid of their loosely attached wings.

Continuing to observe the strange kind of emigration of these insects, commonly called white ants, we find that only a few of these myriads live till the next morning. All those that have not been eaten by the large numbers of mammals, birds, and reptiles eager to swallow them have been caught by the busy

workers of the white ants, and elected as heads of a future family. A clay cell, shaped like a watch-glass, serves for the royal pair, first as a dwelling and later as their grave. They are never allowed to leave it. The entrance is carefully walled up, and at first only one small hole is left for the workers to go in and out. Food is brought in and consumed. The queen grows visibly, and begins soon to lay the eggs of the coming brood. The number of eggs is immense; the statements vary between eighty in every minute and eighty thousand in twenty-four hours. As the same queen continues to lay eggs for two years, at least in some species, some forty millions of eggs will have been laid during this time. This large number is not exaggerated; indeed, the fecundity of some common insects goes much beyond this. The common blue-bottle fly has in one summer five hundred millions of descendants, and the plant-louse has in one year, in the fifth generation, six thousand millions, and still continues to lay eggs when the ninth generation is already fit for propagation. Among the vertebrates some fishes have a comparatively numerous progeny.

The growth of the queen increases in proportion to the number of eggs forming in her body. When full-grown she is several thousand times as large as before; that is, her abdomen only has grown from one half an inch to six and even eight inches in length. The whole body resembles a thick worm, covered at regular distances with brown spots, the former segments of the abdomen. The delicate feet are completely unable to move the body, out of which the eggs are forced by an incessant peristaltic motion.

Meanwhile the cell of the so-called queen has been widened according to necessity. A gang of workers, forming a chain, moves about the floor and carries the eggs into the nurseries near by. To shorten the way they make little holes in the walls of the cell at regular distances. Soon we find a motley crowd crawling about in the nest; very young larvæ, workers and soldiers, two aborted forms of both sexes, nymphæ, and later, mingled with them, the full-grown winged imago.

But the nest has become too small, and we now see similar hills rising near by; then the partition walls are broken to connect the new dwellings with the old ones; and additions to the family force the brood to repeat the operation. Larger species in the tropics raise hills to twelve feet and more in height, strong enough to resist the influence of the tropical rains, and to render difficult their destruction by men or animals.

The whole is built up by the blind workers in the dark, for it is a peculiarity of the white ants that they shun the daylight. No matter how far they intend to go, they build *a pipe of clay* of about a quill's diameter, forming a viaduct, the inside of which is quite smooth, whilst the outside is more or less rough. It is wonderful how quickly the work progresses. In a file each worker carries to the right place a small particle of loam, mixed with its saliva. Without interruption the little troop is busily engaged, and such pipes have been observed to progress two inches in a single hour, and six feet during one night.

When the work is damaged, the workers retire, frightened, and in the breach appear the thick-headed soldiers; first one, then more, in such a hurry that often the foremost are thrown down by the eagerly pressing crowds. Opening their jaws wide, they move their heads threateningly to reach the enemy, and at the same time make a peculiar hissing sound. Furiously they beat at everything in their way, and not infrequently put to flight barefooted intruders. The soldiers do not help at the work; protection is their only duty. They are blind, like the workers.

There are some very curious facts observed concerning the instinct of these little animals. As the whole nest would die with the premature death of the queen, sometimes two equally well-developed queens are found in the same cell, but the rather impolite workers have built between them a partition, beginning at the ceiling but not quite reaching the floor. Therefore only conversation is possible; perhaps they think that two queens would not live peaceably so near together. Every society provides carefully for a substitute in case of the queen's death, and in a small cell, shaped like that of the queen, two or three individuals are found, prepared, if wanted, to take her place.

All the species of the white ants which build hills belong to the tropics. But besides these, there exist numerous species which build curious nests in the tops of trees, or beneath the surface of the earth, or which live in decayed trees and in every kind of decayed wood. Two of the latter kind, very similar to each other, live in Europe and North America; and about these in particular, and their dangerous habits, I propose to make some observations.

The European species (*Termes lucifugus*) has been observed by naturalists for nearly a century. The little dark-brown insect, living under stones or in old decayed trees, had until recently never

been injurious. Even its appearance in myriads after the falling of an old uninhabited house in Rochefort, in France, did not draw the attention of the people to the danger. Some time afterwards more accidents happened. In a boarding-house a whole dinner party fell suddenly from the third story down into the cellar, and some other buildings threatened similar mishaps. The danger was increased, as each owner carefully denied having these fearful guests, for fear of depreciating the value of his house. The anvil of an industrious blacksmith yielded under his hammer, and the block supporting it broke to pieces, entirely destroyed by white ants. The attention of the government was drawn finally to the danger by the destruction of the costly timber stored in the navy yard for the building of men-of-war, and the destruction of the naval archives. Several times scientific commissions were sent to investigate the new pest and to propose remedies; and scientific societies in vain offered prizes for the fortunate destroyer of these animals. Nevertheless every remedy proved useless, as refuse and manure spread the obnoxious insects further. Constant attention and the destruction of the pipes, and use principally of only metal and stone for the construction of new buildings, were considered the only remedies against the white ants. Some years later they did less damage, and disappeared, as insect pests commonly do, without any known reason. For the last twenty years they have existed everywhere in the formerly infected departments, but without being obnoxious.

The North American species (*Termes flavipes*) in form and color is very much like the European, but differs in the more yellowish legs. The species has been known to science since the end of the last century. Their obnoxious power was first shown in Europe, in the beautiful hot-houses at Schoenbrunn, belonging to the Emperor of Austria. The insect was believed, probably by mistake, to have been imported with plants from South America, for till now this species has not been observed south of the North American continent. It was not possible to get rid of them in Schoenbrunn, in spite of great expense and careful labor. One of the largest hot-houses was so nearly destroyed by them that it had to be torn down to prevent its falling to ruin. Besides the beams, they had destroyed the tubs in which the plants were set. The new hot-houses were built of iron, but the white ants are still living in them.

The whole region of the United States east of the Rocky Mountains possesses only one species, the above-mentioned *T.*

flavipes, spreading from the Gulf to the Lakes, and from the Atlantic to the westward beyond the Mississippi. This white ant seems to be common everywhere; it is very abundant in New England, and from my personal observation is to be found everywhere around Boston, in its suburbs and in the surrounding country, within a radius of ten miles. It lives in old stumps, in dead trees, and in fences, logs, and every kind of rotten wood. So far as is known, living trees are not attacked.

The full-grown insect swarms in June more or less numerously, and nearly every year local newspapers give some account of an irruption. Curiously enough, and although many observers were eager to follow the insects to their nest, till recently none had been discovered. Only a few months ago, in the southern part of Florida one was found by chance in an old rotten log, and the queen sent to the Cambridge Museum. I have tried to discover the nest here since I was invited to come to Cambridge by the late Professor Agassiz, and I have repeatedly given serious attention to this subject. But I never succeeded. I beg to mention only one of my experiments. A board which lay about twenty steps from the corner of the museum when I arrived, eight years ago, was left in the same spot five years for the purpose of covering wet places in the spring and in the fall. Suddenly in June, 1872, it proved to be infested and covered with thousands of white ants. Of course they must have come through the ground, and I tried carefully to discover the passages and holes, in order to find a clew to the nest. The whole ground beneath the board and its neighborhood was examined, and the loam carefully displaced. But no trace was found. I have no doubt that some old stumps in the surrounding estates will be the right place, but they are too numerous to enable us to find the right one. The only scientific conclusion to be made is that the white ants spread commonly very far around their nest underneath the ground, and appear above as far as possible from the nest. It is very obvious that by this habit the danger is aggravated, and the remedy, that is, the destruction of the nest, difficult to apply.

My inquiries as to whether there had been observed any mischief done by white ants here were always answered in the negative. Only one fact was known. About ten years ago, in a hot-house at Salem, the grape-vine was destroyed by them, and curiously enough in the same way as in Europe, and I am informed that the sills of houses and decaying trees in that city are

tenanted by them. Two years later I was presented by the late B. Walsh, in Rock Island, with a copy of the state papers of Illinois, which were destroyed by white ants. All the spare copies were stored in a closed room, and not looked after for some time; when the room was opened all were found in the same condition. I can never look upon the volume without being puzzled by the remarkable fact that the queer little rogues failed to attack the name of Vandalia on the top of the pages. Several years later a Boston lady, a teacher in one of the freedmen's schools in South Carolina, who had gone away for a vacation of six weeks, found, on returning, the whole library destroyed, Bibles and prayer-books. The copies kindly forwarded to me were less damaged, and therefore retained.

Here, around Boston, old fences are the favorite dwelling of the white ants. The old fence around the Observatory in Cambridge was the easiest place to collect them. The fence was replaced last fall by a new one. In the report the expense was marked down as a large one. If we consider the danger to the library and the records of the Observatory, which, once destroyed, never could be replaced, we shall agree that the expense is a real benefit. In the Botanical Garden, white ants are equally numerous. A few years ago I had the opportunity of seeing white ants swarm in clouds in the Botanical Garden. A whole army ascended the steps to the herbarium. I was frightened by the possible danger to this treasure. But the answer that all the plants in the herbarium were poisoned turned directly my compassion to the side of the little strolling wanderers. Nevertheless, the costly library of the Botanical Garden is certainly not poisoned, and doubtless somewhat in danger. I tried to find the centre for the large distribution of white ants around the Observatory and the Botanical Garden, and I believe I am right in regarding it as existing in a very old estate just opposite to the Botanical Garden. Near Spy Pond I had for several years a good collecting place for white ants in a venerable giant of pine, dead perhaps for many years, but removed the last winter; in the many old stumps around it, however, the nest was not discovered.

Near Winchester, on Mystic Pond, the fish commission has built a remarkable fishway for alewives, near a sluice. Two years ago I examined the posts and stumps around it, and found them infested with white ants. Till now they have done no damage. I have no positive information that mill-dams are damaged by white ants, but I cannot help believing that at least

in some cases of ruptures of dams, so frequent of late years, white ants may have had some part at least in helping the destruction. The same remark applies to wooden bridges. I can only give one fact which I believe belongs here. Near Porter's Station, in Cambridge, was a wooden bridge for cattle driving, which gave way, as it was stated, by a large number of cattle running across it. Trains stop forty times or more daily at Porter's Station, and the bridge was so situated just above the engine that it was moistened by the hot steam, the best accommodation which white ants would choose. I am told that the broken wood had been sound, but I can state that white ants swarmed last year on both ends of the broken bridge. Even now the outside of the old bridge remains near the newly-built one, and the wood is thoroughly rotten and eaten by insects. I have always wondered that houses were never attacked. Now it is done. Some years ago, Mr. Alvan Clark, the world-wide known maker of astronomical instruments, visited the Museum of Comparative Zoölogy. When I showed him the biological collection of white ants, he told me that he knew them very well, because they swarmed every year in January in his workshop. Afterwards, while I was on a visit there, he showed me that the timber around the furnace in his shop was entirely infested by them. This year, suddenly the ceiling above the furnace, where the wood is constantly moistened by hot steam, gave way for about an inch, and he was obliged to support the whole by posts and jack-screws. A gentleman from Roxbury, when I showed him wood damaged by white ants, told me that an old shanty on his estate came down, and the wood looked just like the piece I showed him. From some lumbermen I heard that such wood was known by the name of powder-dust, and I found beautiful pieces of it among large piles of lumber near Lake Winnipiseogee. I am happy to state that I know of no other damage done here by white ants. But their habit of working without injuring the outer surface of the eaten wood, and the immense damage done by a nearly-related species, makes it a duty, I believe, for everybody to be on his guard. White ants are every year swarming around the Museum of Comparative Zoölogy, the Botanical Garden, and the Observatory. Collections and large libraries are in the neighborhood, and it should not be forgotten that A. von Humboldt stated half a century ago that the rarity of old books in New Spain was the consequence of the depredations of white ants. I have no proof that white ants are living in the city of

Boston itself, but there can be no doubt of it. Old posts, plankways, fences, stumps, are everywhere their favorite dwelling, and there is no lack of this sort of rubbish in many places. In East Boston their appearance was recorded several years ago by newspapers.

The question, What can be done to prevent as much as possible the danger? is a natural one. I have thought much about what should be recommended, and I will try to give some hints which may perhaps be accepted. The remedies (the large number of which shows their insufficiency) recommended for the destruction of white ants in the tropics fill a whole literature. I will not forget to mention that as every calamity is used by rogues to cover their bad doings; even the destruction by white ants was used in such a way. When a very large property, stored by the government in Isle de France, was reported as destroyed by white ants, the ministers sent to the officers a box containing files, with the strict order to file off the teeth of each ant or to resign the place. Since then the white ants have been harmless, at least comparatively so.

The substance of the propositions recommended by me would be as follows:—

(1.) We must know that we live surrounded by such enemies, and that great destruction can be done. If we look straight in the face of an enemy and know the power he can develop, the battle is half won. Nothing is more dangerous than underrating or overlooking the power of even the feeblest enemy.

(2.) We must not try to find a remedy to exterminate them entirely and at once. Such exertions are fruitless. We must try to diminish the danger to the smallest possible degree. The life of man is a continuous struggle with a host of enemies which he cannot exterminate. They must be avoided or conquered.

(3.) The remedy must be a reasonable one. For instance, it would be absurd to recommend not to build houses of wood in a country where certainly wooden buildings are the most healthy, considering the great changes of temperature, the great humidity of the air, and above all the convenience of such houses.

The diminishing of the progeny of animals is done in the simplest way by depriving them of food. Now the food of white ants is principally old rotten wood, and I think the first step should be to take away all that is possible of such stuff. Old stumps are the principal dwellings for white ants, preserving them through the winter. Therefore every old stump should be

removed, at least near cities and towns. For old fences, I believe this will be more difficult, but I see no other help, at least near cities and towns. It should not be overlooked that a sudden removal of a large quantity of such infested wood might bring about a sudden calamity by a larger spreading of the disturbed and starved animals. But it should also be considered that in deferring this necessary remedy the evil would be greater, and only postponed; the ants would spread more and more, and a later generation would deplore the lack of attention given by their forefathers. I think if the removal was effected in winter time, when the ants are weaker, and a large part would die in the cold weather by exposure, or by simple chemicals put in the hole, the danger would not be so great that it could not be overcome. Of course I would condemn also all useless pieces of wood lying around, also old forgotten shanties and similar structures.

A very important point would be not to have well-manured flower-beds just around and near to the wall of wooden dwelling-houses. The soil in such beds is always less compact and warmer, and I have observed in such beds in the early spring swarming white ants. I think it would be best to have around the houses for a certain distance clay or gravel, as the white ants do not seem to like them.

It should be remembered that in railway depots and stations the engines should not stop daily on a spot where bridges or similar wooden structures are moistened by the steam. Of course the same precaution would be commendable in manufactories.

These seemingly not very significant measures, if followed strictly, would, I think, prevent the greatest part of the danger. Continued attention would be the principal, and this would be easy, as the swarming of the white ants in the summer indicates to every one their presence.

I should be sorry if the lugubrious picture of the possible calamity, which may seriously endanger a flourishing country, should be thought too darkly shaded or perhaps sensational. This has of course not been my intention. I have only tried to draw attention to an enemy with which we have lived until now peaceably, without knowing its dangerous power, a power which can be developed at any time, if precautions are not taken to destroy it.

White ants are only the police of nature. If mankind takes the police in his hands, nature steps behind. White ants retreat step by step before the advancing culture. In Africa and India,

where a century ago immense ant-hills were to be found near the shore, now some days' journeys inland have to be made to find them. We are justified in hoping for this retreat of white ants here, in front of a rapidly advancing culture.

EXPLORATION OF A MOUND IN UTAH.

INFORMATION having been received that a mound existed on Santa Clara River, a few miles from the village of St. George, in Southern Utah, which from its position promised to yield interesting results, it was deemed of sufficient importance to have it explored. Dr. E. Palmer, being in that neighborhood last fall, was requested to direct the operations in the interest of the National Museum. The report which he submitted gives interesting details of what he observed during the progress of the work, and his impressions explanatory of the same.

With the necessary workmen and tools he proceeded to the mound in question, on the east side of the Santa Clara River, about three miles from St. George, Utah, and camped at its base. A general view of the situation showed an isolated elevation which had originally covered about half an acre of ground with a varying height of ten or twelve feet, which had been cut away nearly one half on the side of the river by the action of its waters during a freshet in 1861 or 1862. The outline it presented on the ground was quite irregular. The rise in the river had changed the position of the channel, and deepened it and also made it wider. At this time, however, the stream is reduced to a very small width, say from twelve to fifteen feet. What remained of the mound was quite a conspicuous object in the landscape, about forty feet from the river-bed, with a vertical escarpment on that side, but evidently it had been a circular work before its partial demolition by the river. The lines of stratification seen on the river front were conclusive as to its having been piled up by human agency, showing various horizons from the base up, on which dwellings had been erected and occupied by the residents of the spot until some member of the household, probably the head, should die, when it was burned down with all its appurtenances, the dead body included; leaving a deposit of ashes with incombustible stone implements to designate the location.

The construction of the dwellings was studied out on the spot and was found to be for the most part of upright sticks or staves,